

**Citation:**

Bisset S, Gauvin L, Potvin L, Paradis G. Association of body mass index and dietary restraint with changes in eating behaviour throughout late childhood and early adolescence: a 5-year study. *Public Health Nutrition*. 2007;10(8):780-789.

**PubMed ID:** [17381909](#)

**Study Design:**

Prospective cohort study

**Class:**

B - [Click here](#) for explanation of classification scheme.

**Research Design and Implementation Rating:**

 POSITIVE: See Research Design and Implementation Criteria Checklist below.

**Research Purpose:**

To describe patterns of dietary behaviours during the transition from childhood to adolescence and to examine how these patterns are associated with tendencies towards dietary restraint and the occurrence of overweight and obesity in mid-adolescence.

**Inclusion Criteria:**

Students from grade four classes in 14 rural, five suburban and 13 urban elementary schools from control and experimental sites of the Quebec Heart Health Demonstration Project.

**Exclusion Criteria:**

Students who provided unusable data on diet, gender, place of residence, physical activity or smoking, weight, height or dietary restraint.

**Description of Study Protocol:****Recruitment**

Students were recruited from Grade four classes from 14 rural, five suburban and 13 urban elementary schools in control and experimental sites of the Quebec Heart Health Demonstration Project.

**Design:** prospective cohort study

**Blinding used (if applicable)**

N/A

## **Intervention (if applicable)**

Data were collected in classrooms by self-administered questionnaires under the supervision of a trained interviewer.

## **Statistical Analysis**

Hierarchical linear modelling analyses (HLM, version 6.02) were applied to the longitudinal data set, first to describe patterns of each of the three food frequency consumption indices (fruit and vegetable, low quality snacking and fast food) across the 5-year period and next to determine if patterns of eating behaviours during that time were associated with dietary restraint and/or BMI measured in the fifth year of data collection.

## **Data Collection Summary:**

### **Timing of Measurements**

Data were collected at baseline (Grade four, n=1274, 1995), two years later (Grade six, 1997, n=1307), in 1998 (grade 7, n=1189) and in 2000 (Grade 9, n=1354).

### **Dependent Variables**

- BMI kg/m<sup>2</sup>: BMI was estimated using self-reported weight and height and was recorded in the final year of the follow-up when the participants were in the ninth grade. The classification of youth into weight status categories was based on sex- and age-specific BMI cut-offs established by the Centers of Disease Control and Prevention growth charts.
- Dietary restraint as measured by the Dutch Eating Behavior Questionnaire: Dietary restraint was evaluated only during the final year of the study. Questions on restrained eating were taken from the Dutch Eating Behavior Questionnaire (DEBQ).

### **Independent Variables**

- Eating behavior was measured with the same self-administered food-frequency questionnaire at each data collection point. Responses were summed to create an index of weekly consumption for each of fruit and vegetable consumption, low quality snacking and fast food consumption (Responses: 'not at all'=0; one or several times=3.5; daily=7).
  - Fruit and vegetable intake: four items: 1) fruits, 2) cooked vegetables, 3) raw vegetables or 4) green salad
  - Intake of low quality snacks: doughnuts, cakes or pastries; 20 chips; 3) candy (sweets) or chocolate bars
  - Fast food consumption (responses: not at all=0; once or twice per week=1.5; 3 or more times per week =3): 1) French fries or poutine (consists of French fries, sauce, and cheese curds), 2) hamburgers 3) hot dogs, 4) fried chicken.

### **Control Variables**

- Physical activity measured as dichotomous variables: vigorous, moderate or mild
- Smoking measured as dichotomous variables: regular, experimental or non-smokers
  - Physical activity and smoking were reported throughout the study; however only data reported during the final year of the follow-up were used.

## **Description of Actual Data Sample:**

**Initial N:**

- 1274 fourth grade students, with participation rates of 74% from rural , 71% from suburban, and 41% from urban communities.
- 377 new students presented for the follow-up survey in 1997 and added to the original cohort.
- A total of 1307 grade 6 pupils were surveyed in 1997
- again surveyed in 1998 (grade 7, n=1189) and in year 2000 (grade 9, n=1354).

**Attrition (final N):**

A total of 1188 participants provided data on at least one occasion and 3417 repeated measures. (627 males). Numbers for analysis after exclusions:

- 1995, N= 812
- 1997, N= 804
- 1998, N=790
- 2000, N=1011

**Age:**

Not described other than grade levels.

**Ethnicity:**

Not described

**Other relevant demographics:****Location**

- Rural 459 (38.6%)
- Suburban 392 (33.0%)
- Urban 337 (28.4%)

**BMI**

- Normal weight or underweight 954 (80.3%)
- Overweight 147 (12.4%)
- Obese 87 (7.3%)

**Dietary restraint**

- Low 390 (32.8%)
- Average 408 (34.3%)
- High 390 (32.8%)

**Anthropometrics**

N/A

**Location:**

Quebec

## **Summary of Results:**

### **Key Findings**

- Over the five year period, there was a decrease in fruit and vegetable consumption ( $P<0.025$ )
  - Students reported consuming fruit and/or vegetables about 17 times per week over the 5-year study (plausible values ranged from 8 to 25). Girls reported a slightly higher rate of consumption (18 times per week,  $P<0.05$ )
- There was an increase in low quality snacking  $P<0.0001$
- Students reported consuming low quality snacks an average of 10 times per week over 5 years (plausible values ranged from 2 to 17).
  - Girls reported lower frequency of low quality snacking than boys at baseline (8 versus 9,  $P<0.001$ )
  - Students living in rural setting consumed low quality snacks more frequently than students living in urban settings (10 versus 9,  $P<0.01$ )
- A decrease in fast food consumption was observed ( $P<0.001$ ).
- Dietary restraint and BMI were associated with dietary behavior ( $r=0.21$ ,  $P<0.001$ ).
- Lower than average dietary restraint was associated with a lower frequency of fast food consumption ( $P<0.001$ ) and greater increase in low quality snacking over the 5-year period ( $P<0.001$ ).
- Higher than average dietary restraint was associated with lesser frequency of low quality snacking at baseline ( $P<0.02$ ).
- A BMI in the obese category was associated with more frequent fast food consumption in the fourth grade and a more rapid drop in fast food consumption over the 5-year period.

### **Results for model of weekly frequency of fruit and vegetable and its association with dietary restraint and BMI.**

Fixed effect	Dietary Restraint		BMI	
	Coefficient (SE)	<i>t</i>	Coefficient (SE)	<i>t</i>
Final estimation of fixed effects				
Baseline intercept, y00	17.42(0.60)	29.26***	16.97(0.55)	30.59***
Girls,y01	0.67(0.32)	2.10*	0.66(0.33)	1.98*
Rural setting,y05	1.19(0.37)	3.17**	1.22(0.37)	3.29***
Suburban setting,y06	1.26(0.39)	3.20**	1.25(0.39)	3.19**

\* $P<0.05$ , \*\* $P<0.01$ , \*\*\* $P<0.001$

### **Results for model of weekly frequency of low quality snacking and its association with dietary restraint and BMI.**

Fixed effect	Dietary Restraint		BMI	
	Coefficient (SE)	<i>t</i>	Coefficient (SE)	<i>t</i>

	Final estimation of fixed effects		Final estimation of fixed effects	
Baseline intercept,	9.35(0.40)	23.14***	9.19(0.38)	24.0***
y00				
Girls,y01	-0.59(0.21)	-2.74**	-0.73(0.22)	-3.33***
Rural setting,y05	0.70(0.25)	2.86**	0.64(0.25)	2.57*
Higher than average dietary restraint, y010	-0.76(0.32)	-2.36*	--	--
Linear increase, y01	0.17(0.09)	1.84	0.34(0.09)	3.87***
Lower than average dietary restraint, y17	0.37(0.08)	4.41***	--	--

\*P<0.05, \*\*P<0.01, \*\*\*P<0.001

### Results for model of weekly frequency of fast food consumption and its association with dietary restraint and BMI.

Fixed effect	Dietary Restraint		BMI	
	Coefficient (SE)	t	Coefficient (SE)	t
	Final estimation of fixed effects		Final estimation of fixed effects	
Baseline intercept,	4.77(0.24)	20.21***	4.55(0.25)	20.42***
y00				
Girls,y01	-0.66(0.11)	-5.88***	-0.65(0.12)	-5.72***
Moderate exercise,y03	-0.50(0.19)	-2.65**	-0.53(0.19)	-2.80**
Suburban setting, y06	-0.45(0.14)	-3.34***	-0.44(0.14)	-3.22**
Regular smoker,y08	0.58(0.22)	2.66**	0.60(0.22)	2.74**
Lower than average dietary restraint, y09	-0.64(0.20)	-3.26***	--	--
Obese,y010	--	--	0.77(0.33)	2.32*
Linear change, y10	-0.38(0.17)	-2.20*	-0.30(0.16)	-1.89
Lower than average dietary restraint, y16	0.35(0.15)	2.29*	--	--
Obese,y17	--	--	-0.60(0.25)	-2.36*

\*P<0.05, \*\*P<0.01, \*\*\*P<0.001

### Other Findings

## **Author Conclusion:**

- Eating behaviors evolve from late childhood to early adolescence and some changes are associated with psychosocial tendencies such as dietary restraint.
- Results show an overall decrease in the frequency of fruit and vegetable consumption with girls reporting a higher frequency of fruit and vegetable consumption and lower frequency of both low quality snacking and fast food consumption than boys.
- Students living in urban settings consumed more fast food and less fruit and vegetables compared to those living in rural or suburban settings.
- Obesity was associated with more stable low quality snacking over time, and with higher fast food consumption at baseline but a greater decline in fast food consumption over time.
- Low dietary restraint was associated with a greater frequency of both fast food consumption and low quality snacking by the end of the study period. Students with low dietary restraint in the ninth grade demonstrated incremental increases in low quality snacking over time. Students who reported low dietary restraint maintained a stable consumption of fast food over time whereas the rest of the sample decreased consumption of fast food over time. At the end of follow-up, consumption of fast food was higher among low dietary restraint than among average and high restrainers.

## **Reviewer Comments:**

- *Obese children may be more likely to practice dietary restraint but may also eat in response to external and negative emotional cues. Underreporting might result from subconscious overeating, particularly in relation to fat intake. Obese children may also be trying to lose weight and thus eating fewer low quality snacks.*
- *Due to this longitudinal design, subject attrition occurred. It is possible that those persons who were not followed-up had different eating behavior patterns from those who were tracked.*
- *BMI and dietary restraint was only measured in grade 9 for feasibility reasons. It is likely that a different result could have been concluded if eating behavior changes over time were linked with changes in weight status and tendencies to restrain food intake over time. In this case, associations in evolution in dietary behaviors with dietary restraint and BMI are cross-sectional and do not suggest causality.*

## **Research Design and Implementation Criteria Checklist: Primary Research**

### **Relevance Questions**

1. Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies) Yes
2. Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about? Yes
3. Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice? Yes

4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes
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## Validity Questions

1.	<b>Was the research question clearly stated?</b>	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	<b>Was the selection of study subjects/patients free from bias?</b>	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	<b>Were study groups comparable?</b>	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	N/A
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	<b>Was method of handling withdrawals described?</b>	Yes

4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%).	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	Yes
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
<b>5.</b>	<b>Was blinding used to prevent introduction of bias?</b>	No
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	No
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
<b>6.</b>	<b>Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening/factors described?</b>	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	N/A
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	N/A
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A

<b>7.</b>	<b>Were outcomes clearly defined and the measurements valid and reliable?</b>	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
<b>8.</b>	<b>Was the statistical analysis appropriate for the study design and type of outcome indicators?</b>	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
<b>9.</b>	<b>Are conclusions supported by results with biases and limitations taken into consideration?</b>	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
<b>10.</b>	<b>Is bias due to study's funding or sponsorship unlikely?</b>	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes

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